Crowell & Moring, L.L.P.
Serial No. NOT YET ASSIGNED
Attorney Docket No. 381AS/50350
Takafumi MATSUMURA et al.
Page 1 of 20

FIG. 1

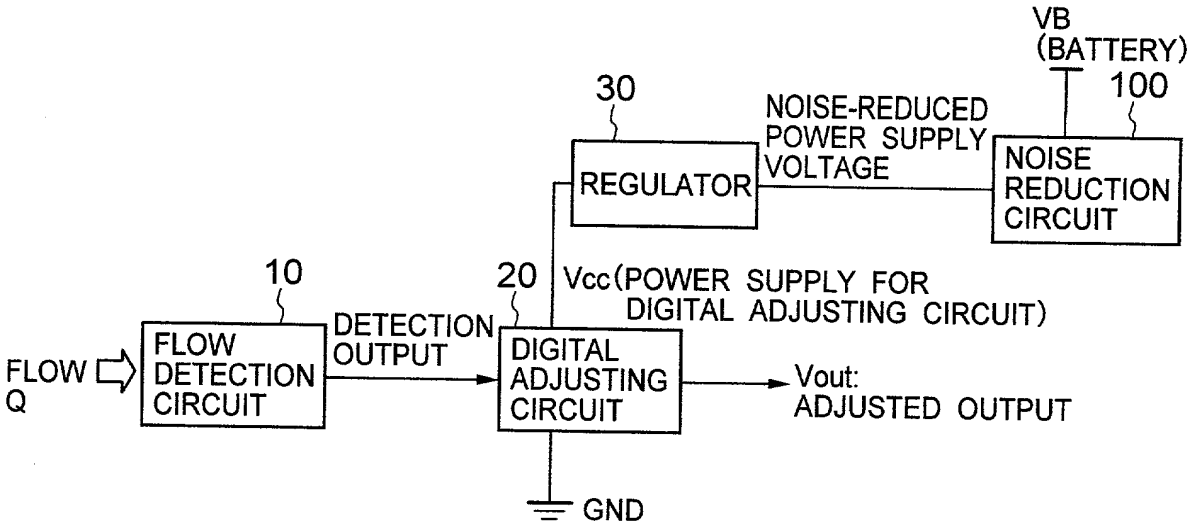


FIG. 2

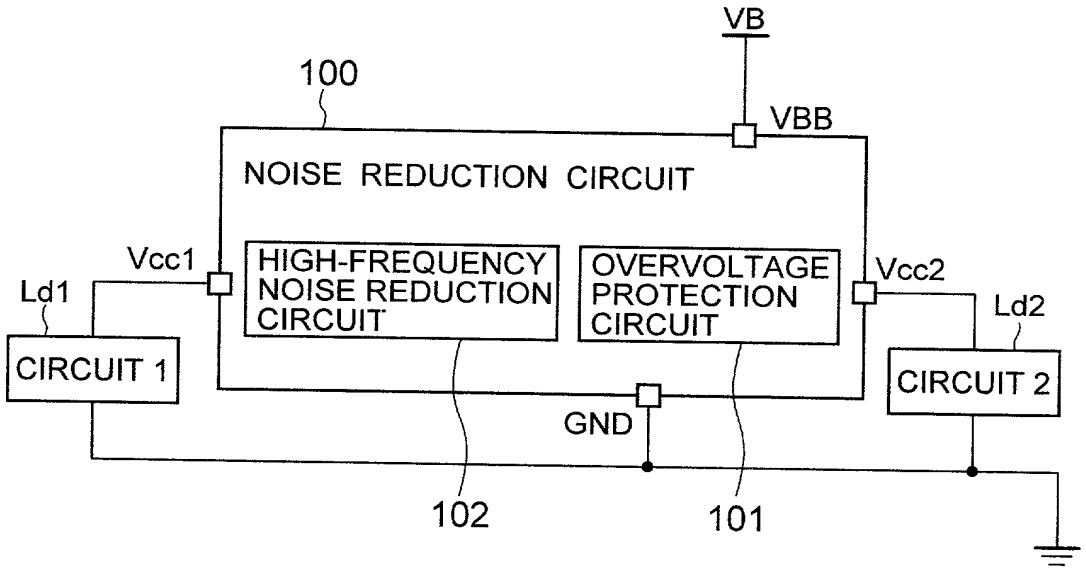


FIG. 3

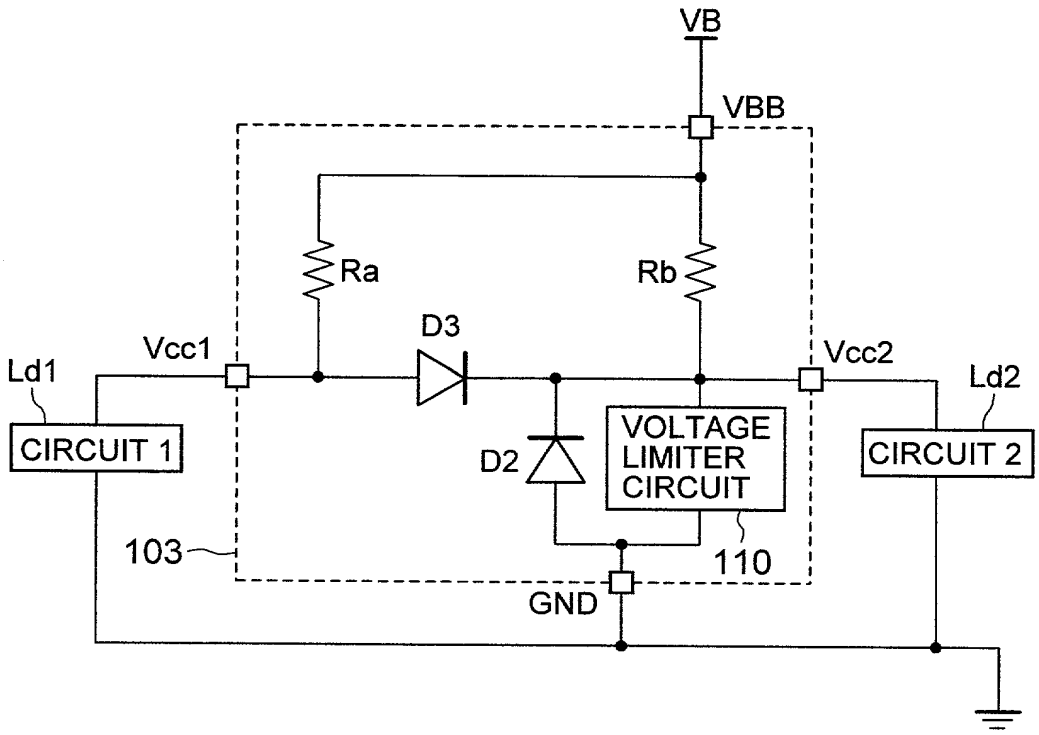

VB
VBB
Ra
Rb
D3
Vcc1
Vcc2
Ld1
Ld2
CIRCUIT 1
CIRCUIT 2
D2
VOLTAGE
LIMITER
CIRCUIT
103
110
GND

FIG. 4

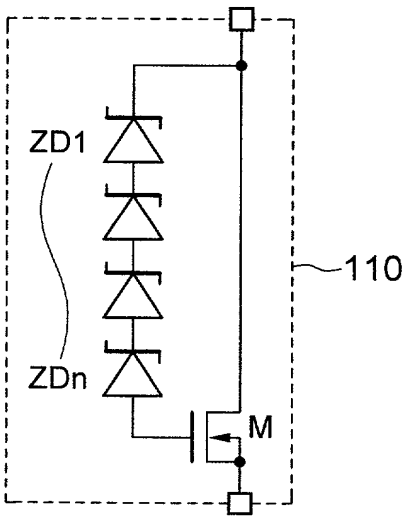

ZD1
ZDn
M
110

FIG. 5

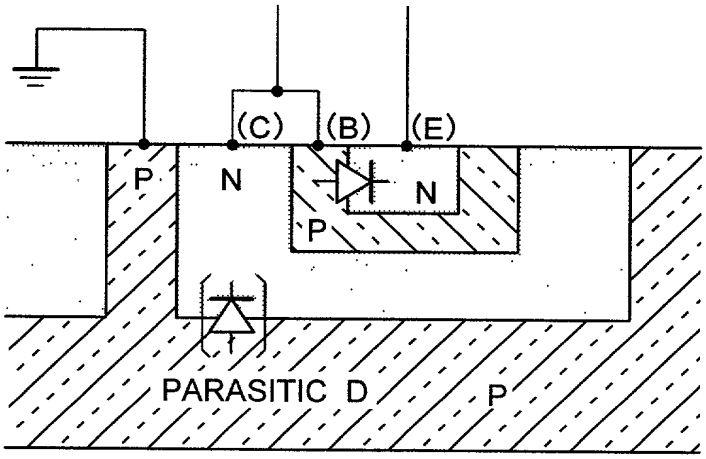

(C)
(B)
(E)
P
N
N
P
PARASITIC D
P

FIG. 6

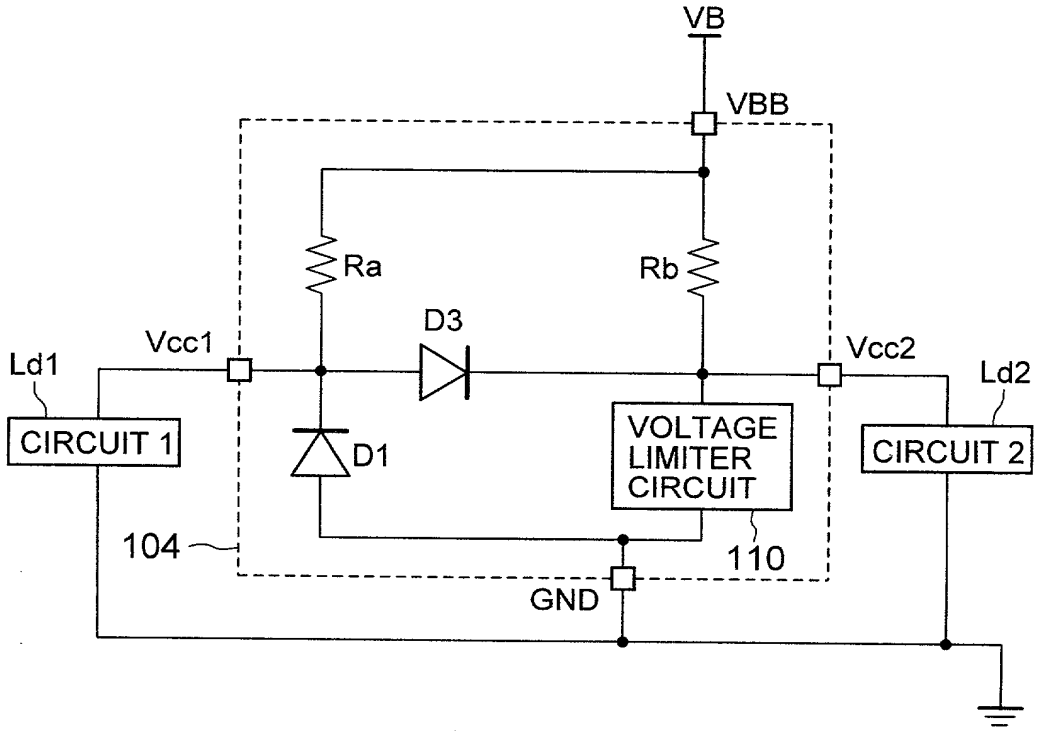

VB
VBB
Ra
Rb
D3
Vcc1
Vcc2
Ld1
Ld2
CIRCUIT 1
D1
VOLTAGE LIMITER CIRCUIT
CIRCUIT 2
104
110
GND

FIG. 7

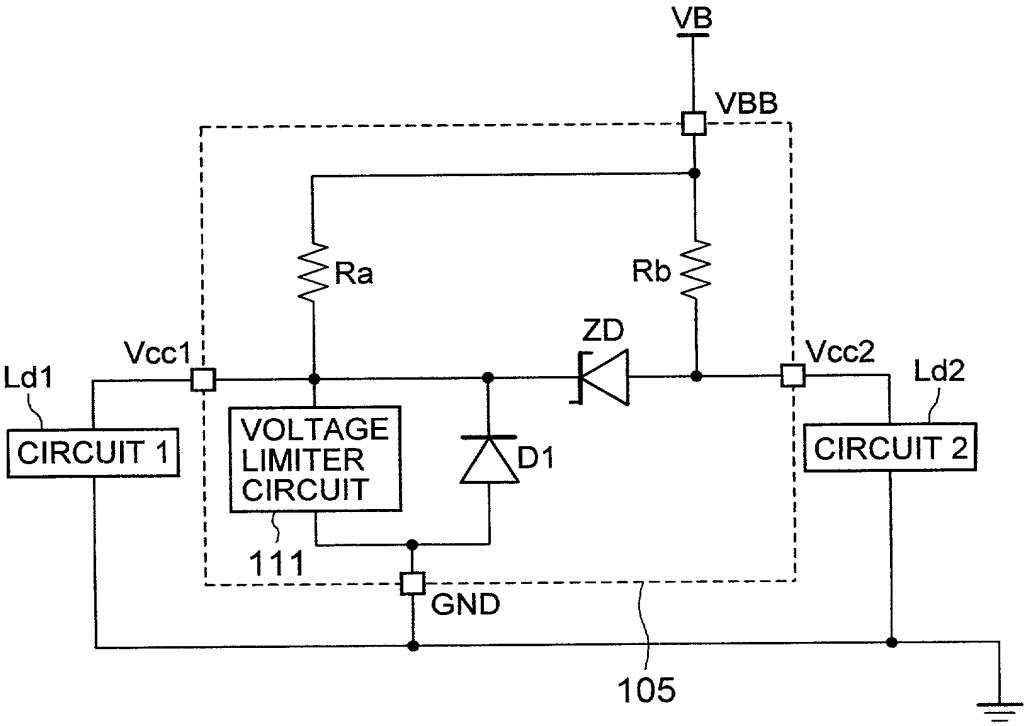

VB
VBB
Ra
Rb
ZD
Vcc1
Vcc2
Ld1
Ld2
CIRCUIT 1
VOLTAGE LIMITER CIRCUIT
D1
CIRCUIT 2
111
GND
105

FIG. 8

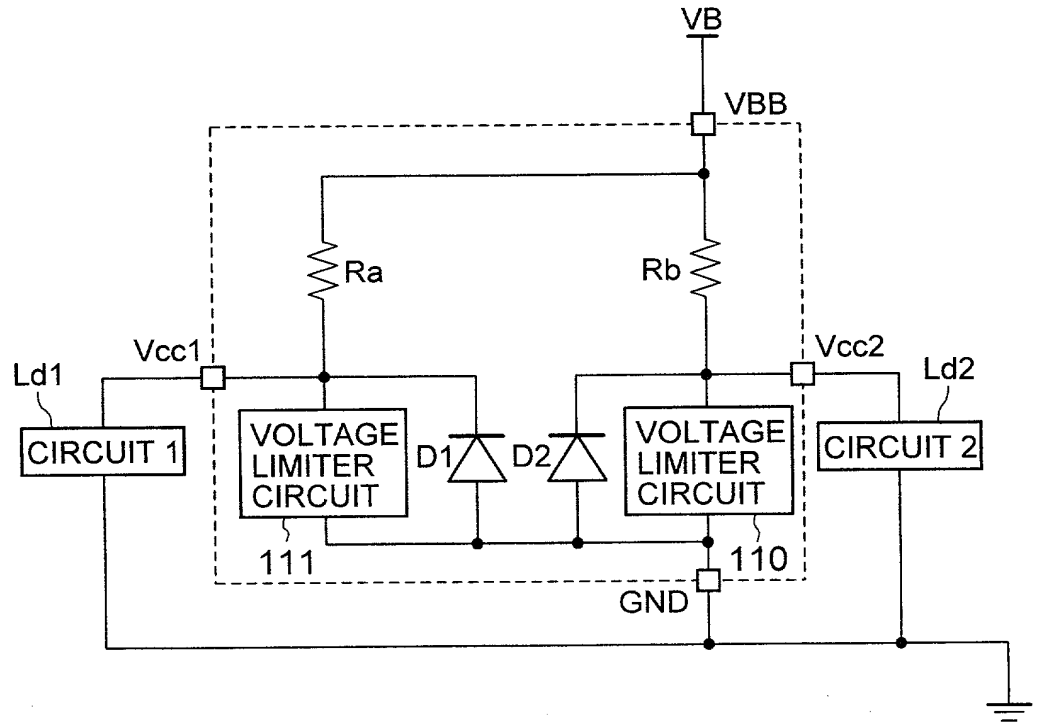

VB
VBB
Ra
Rb
Vcc1
Vcc2
Ld1
Ld2
CIRCUIT 1
VOLTAGE LIMITER CIRCUIT
D1
D2
VOLTAGE LIMITER CIRCUIT
CIRCUIT 2
111
110
GND

FIG. 9

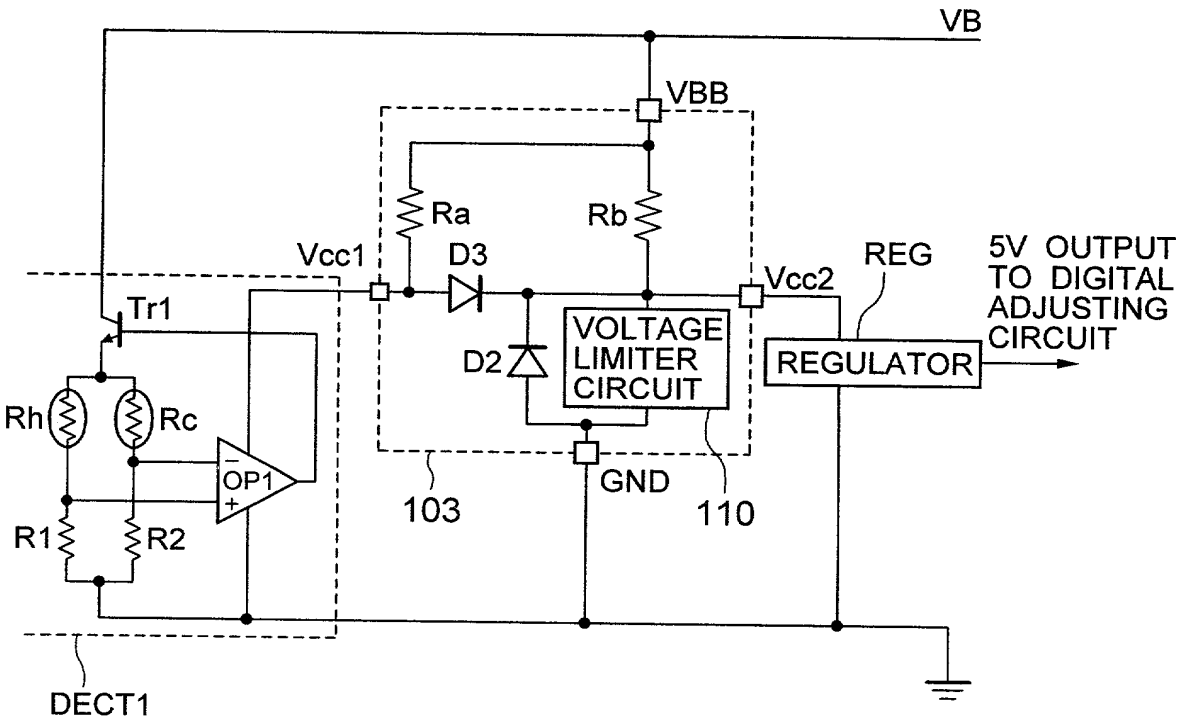

VB
VBB
Ra
Rb
Vcc1
D3
Vcc2
REG
5V OUTPUT TO DIGITAL ADJUSTING CIRCUIT
Tr1
D2
VOLTAGE LIMITER CIRCUIT
REGULATOR
Rh
Rc
OP1
GND
103
110
R1
R2
DECT1

FIG. 10

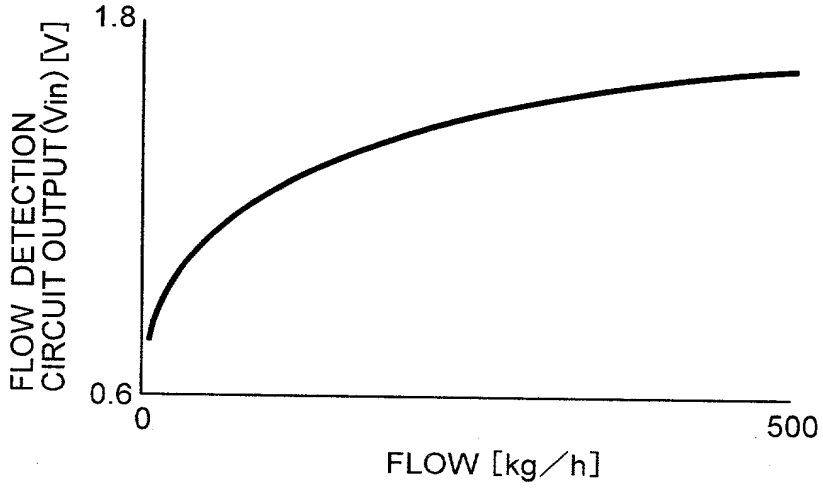

1.8
0.6
0
500
FLOW DETECTION CIRCUIT OUTPUT(Vin) [V]
FLOW [kg/h]

FIG. 11

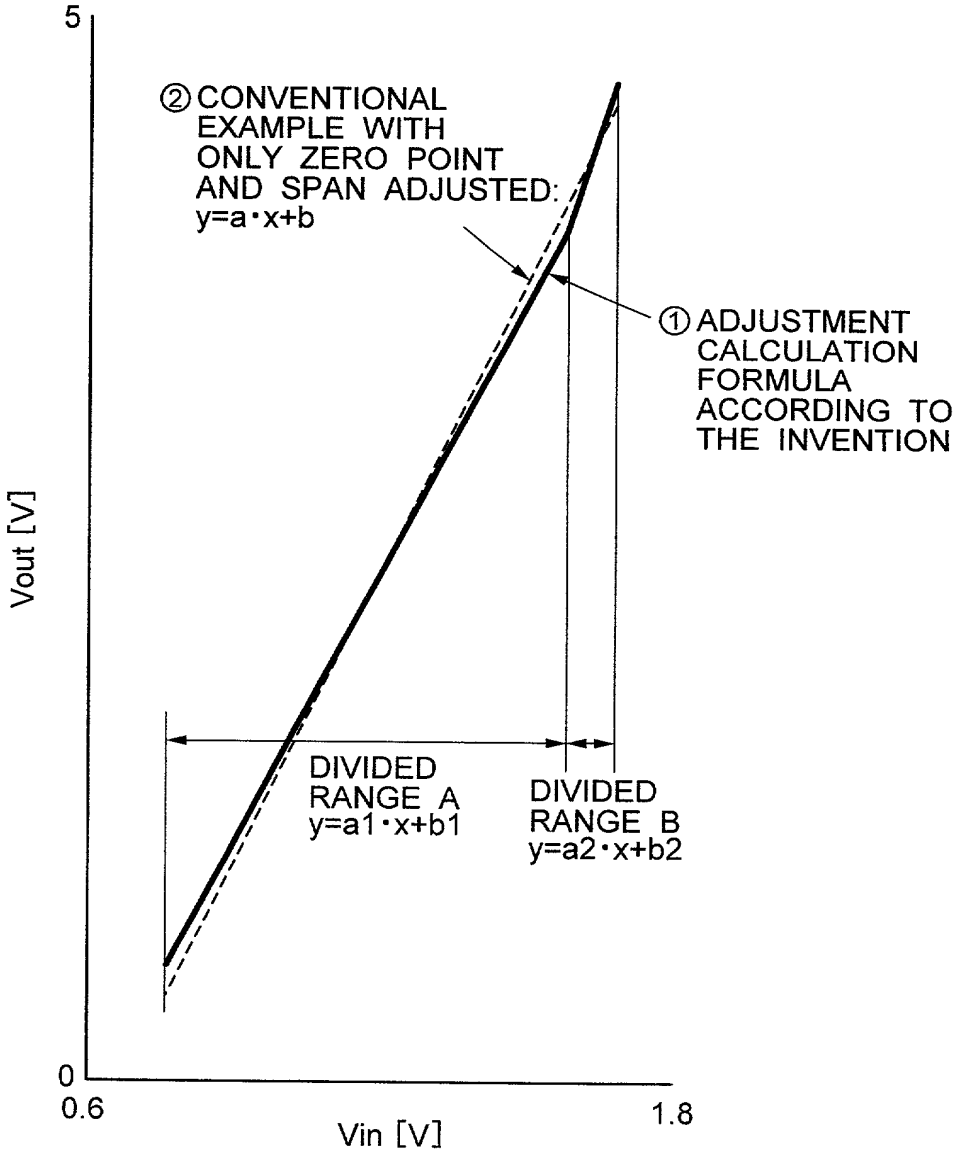

5
0
0.6
1.8
Vout [V]
Vin [V]
② CONVENTIONAL EXAMPLE WITH ONLY ZERO POINT AND SPAN ADJUSTED: y=a・x+b
① ADJUSTMENT CALCULATION FORMULA ACCORDING TO THE INVENTION
DIVIDED RANGE A y=a1・x+b1
DIVIDED RANGE B y=a2・x+b2

FIG. 12

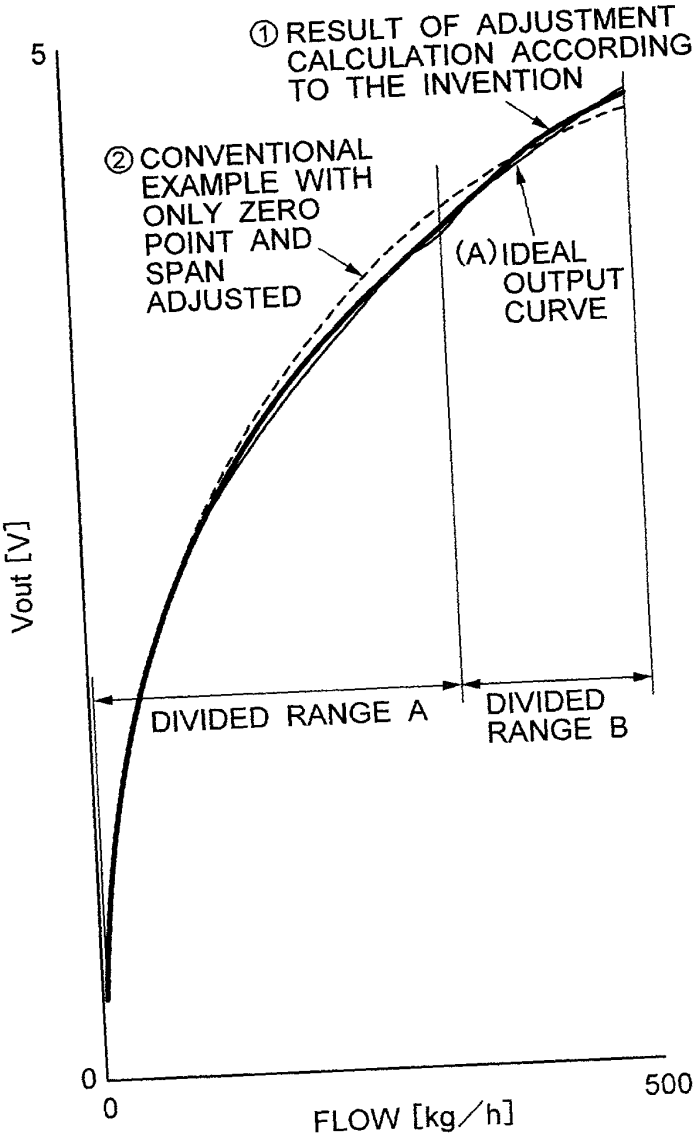

① RESULT OF ADJUSTMENT CALCULATION ACCORDING TO THE INVENTION
② CONVENTIONAL EXAMPLE WITH ONLY ZERO POINT AND SPAN ADJUSTED
(A) IDEAL OUTPUT CURVE
5
0
Vout [V]
0
500
FLOW [kg/h]
DIVIDED RANGE A
DIVIDED RANGE B

FIG. 13

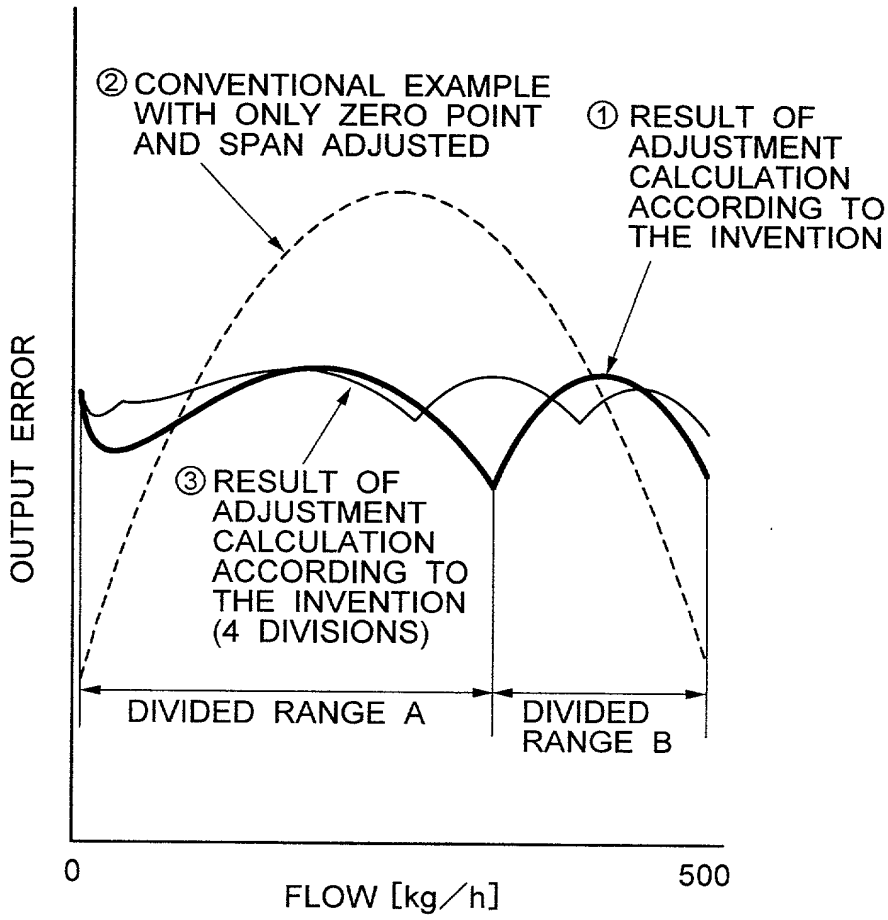

② CONVENTIONAL EXAMPLE WITH ONLY ZERO POINT AND SPAN ADJUSTED
① RESULT OF ADJUSTMENT CALCULATION ACCORDING TO THE INVENTION
③ RESULT OF ADJUSTMENT CALCULATION ACCORDING TO THE INVENTION (4 DIVISIONS)
OUTPUT ERROR
DIVIDED RANGE A
DIVIDED RANGE B
0
500
FLOW [kg/h]

FIG. 14

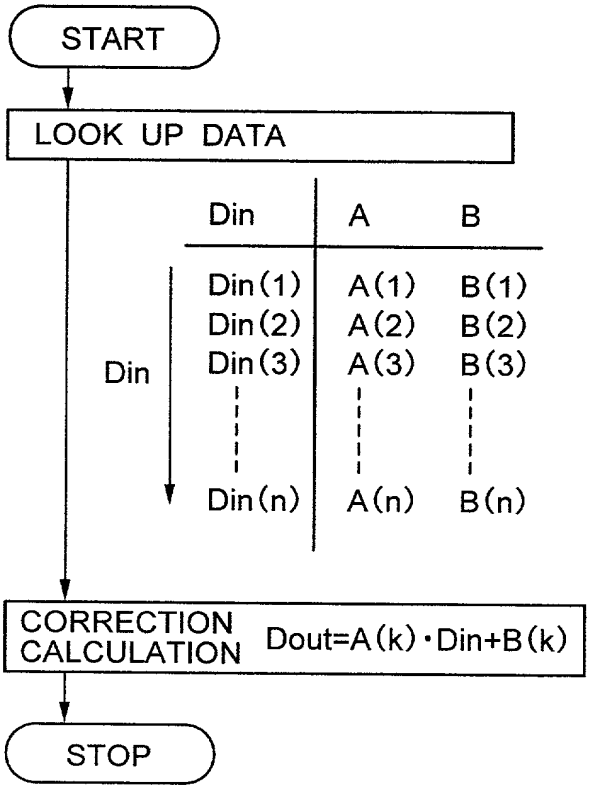

START
LOOK UP DATA
Din
A
B
Din(1)
Din(2)
Din(3)
Din(n)
A(1)
A(2)
A(3)
A(n)
B(1)
B(2)
B(3)
B(n)
Din
CORRECTION CALCULATION
Dout=A(k)·Din+B(k)
STOP

FIG. 15

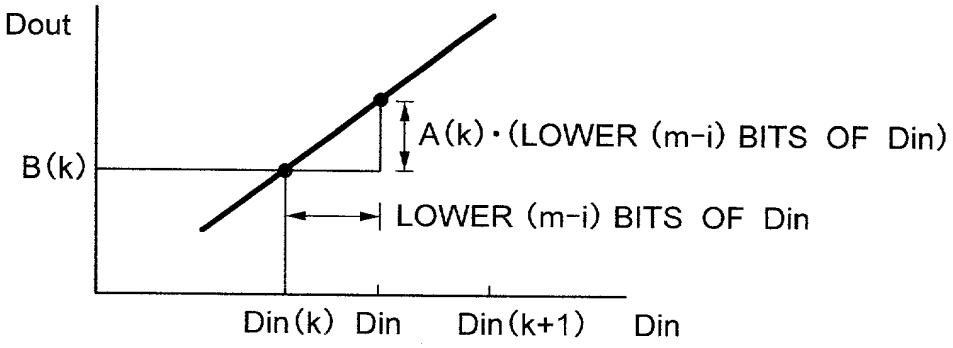

Dout
B(k)
A(k)·(LOWER (m-i) BITS OF Din)
LOWER (m-i) BITS OF Din
Din(k)
Din
Din(k+1)
Din

FIG. 16

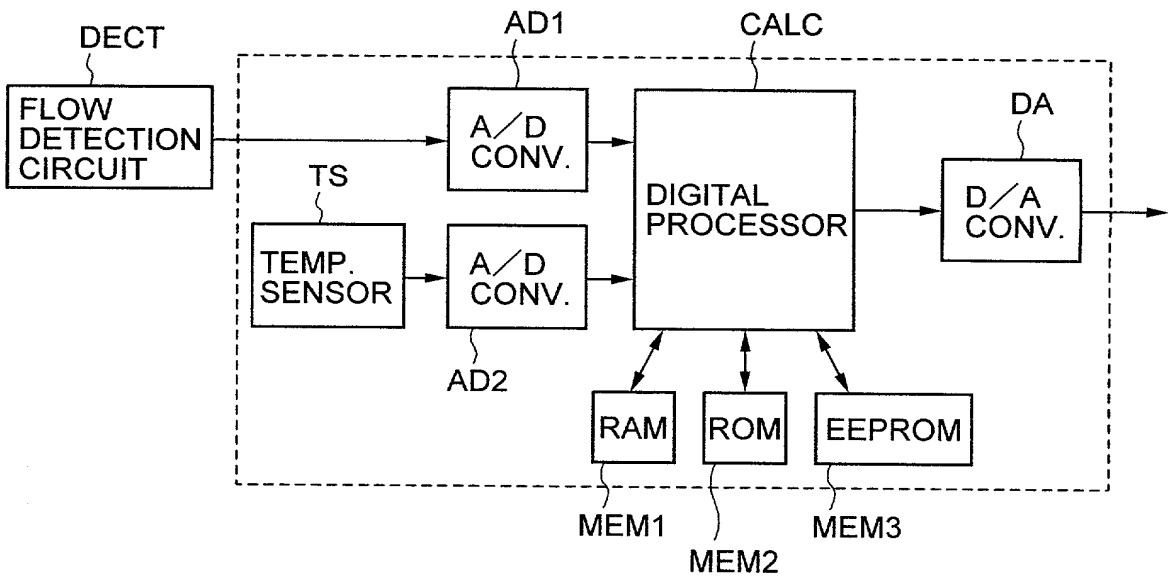

DECT
FLOW DETECTION CIRCUIT
AD1
A/D CONV.
CALC
DIGITAL PROCESSOR
DA
D/A CONV.
TS
TEMP. SENSOR
A/D CONV.
AD2
RAM
ROM
EEPROM
MEM1
MEM2
MEM3

FIG. 17

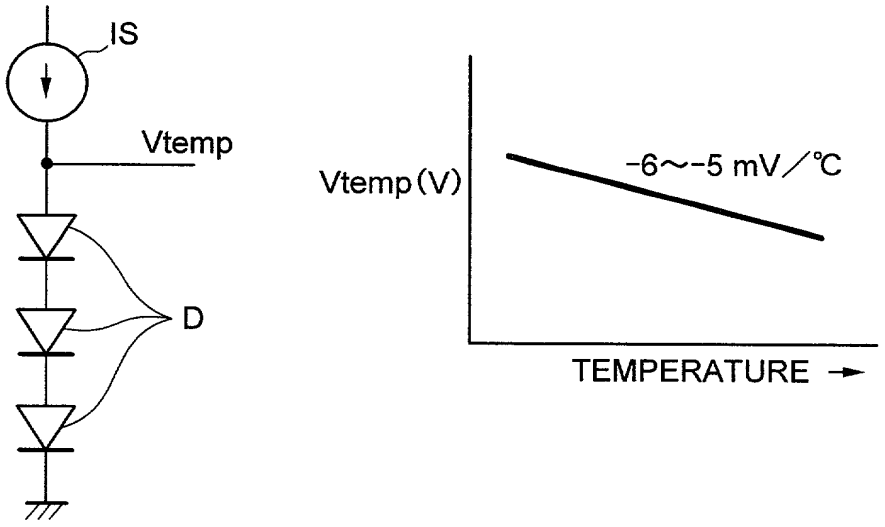
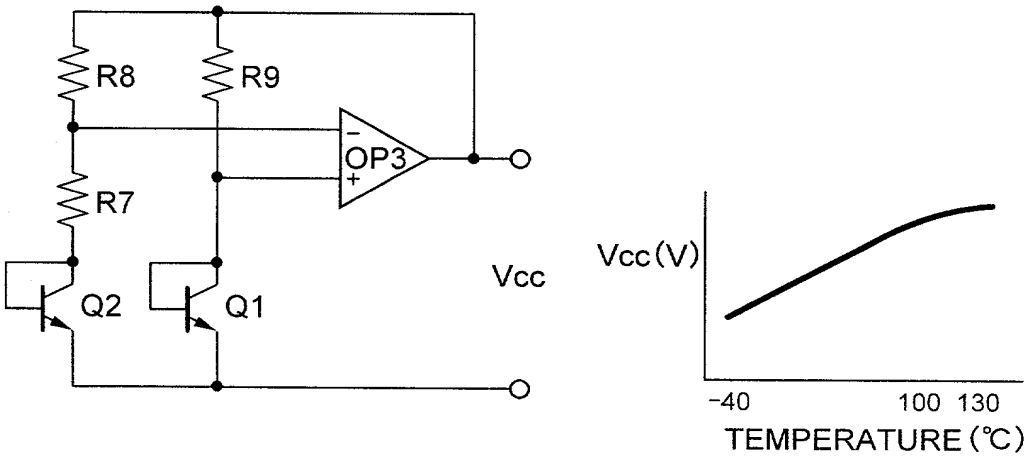
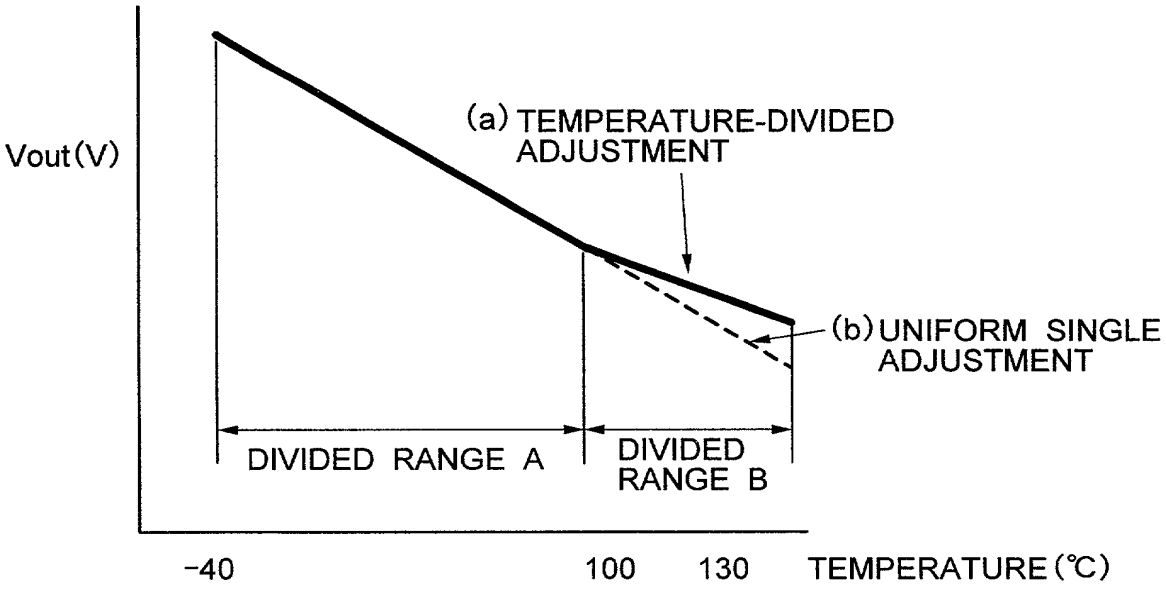

IS
Vtemp
D
Vtemp (V)
-6～-5 mV／℃
TEMPERATURE

FIG. 18


R8
R9
R7
OP3
Q2
Q1
Vcc
Vcc (V)
-40
100
130
TEMPERATURE (℃)

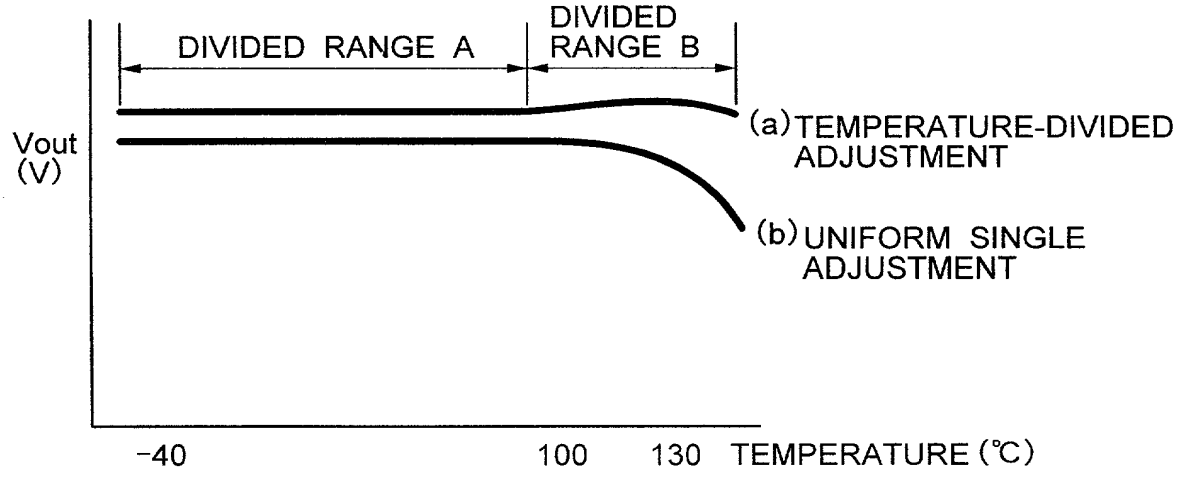
JP2003-050168-A 2003.02.21

FIG. 19A



ADJUSTMENT CALCULATION FORMULA FOR TEMPERATURE CHARACTERISTIC (CONSTANT FLOW)

FIG. 19B



OUTPUT CHARACTERISTIC ERROR AFTER TEMPERATURE CHARACTERISTIC ADJUSTMENT (CONSTANT FLOW)

FIG. 20

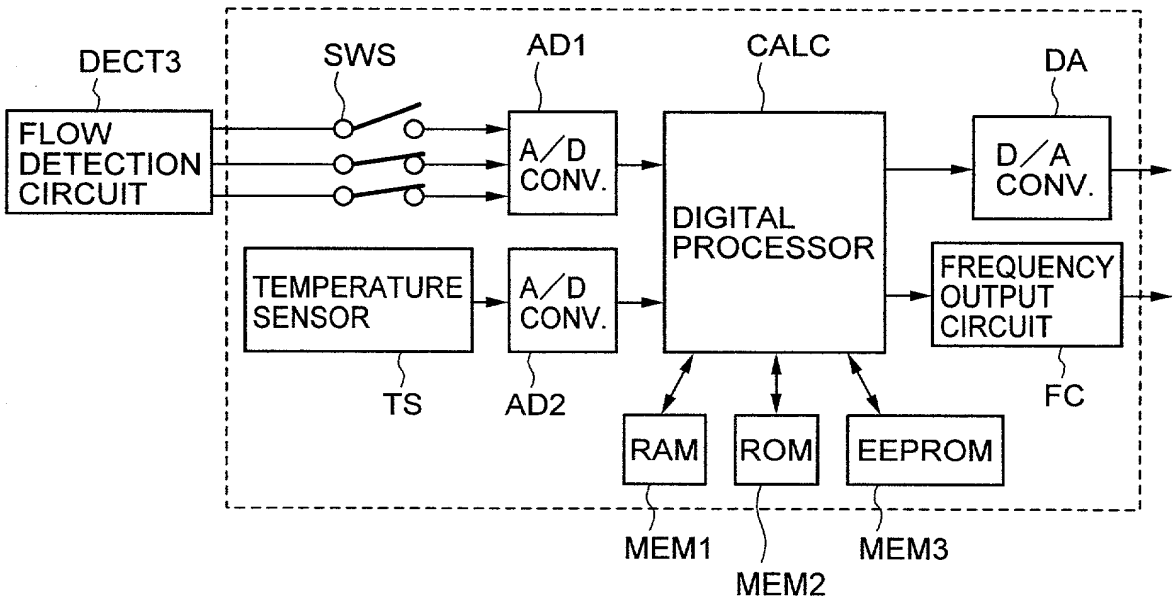

DECT3
SWS
AD1
CALC
DA
FLOW DETECTION CIRCUIT
A/D CONV.
DIGITAL PROCESSOR
D/A CONV.
TEMPERATURE SENSOR
A/D CONV.
FREQUENCY OUTPUT CIRCUIT
TS
AD2
FC
RAM
ROM
EEPROM
MEM1
MEM2
MEM3

FIG. 21

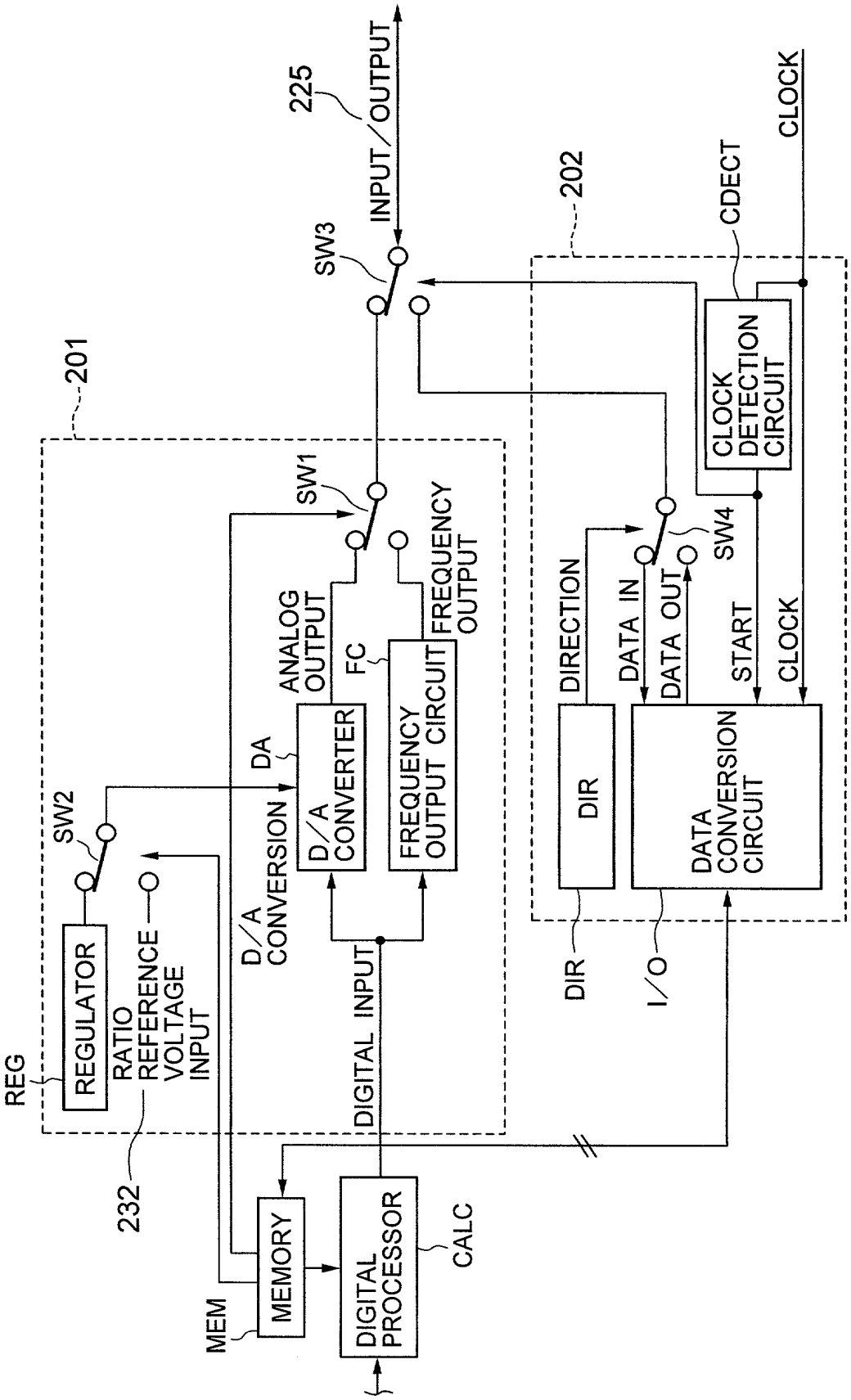

225
INPUT/OUTPUT
SW3
201
202
CDECT
CLOCK
CLOCK DETECTION CIRCUIT
SW1
SW4
ANALOG OUTPUT
FC
FREQUENCY OUTPUT
DIRECTION
DATA IN
DATA OUT
START
CLOCK
DA
D/A CONVERTER
FREQUENCY OUTPUT CIRCUIT
DIR
DATA CONVERSION CIRCUIT
SW2
D/A CONVERSION
REG
REGULATOR
RATIO REFERENCE VOLTAGE INPUT
DIGITAL INPUT
DIR
I/O
232
MEM
MEMORY
DIGITAL PROCESSOR
CALC

FIG. 22

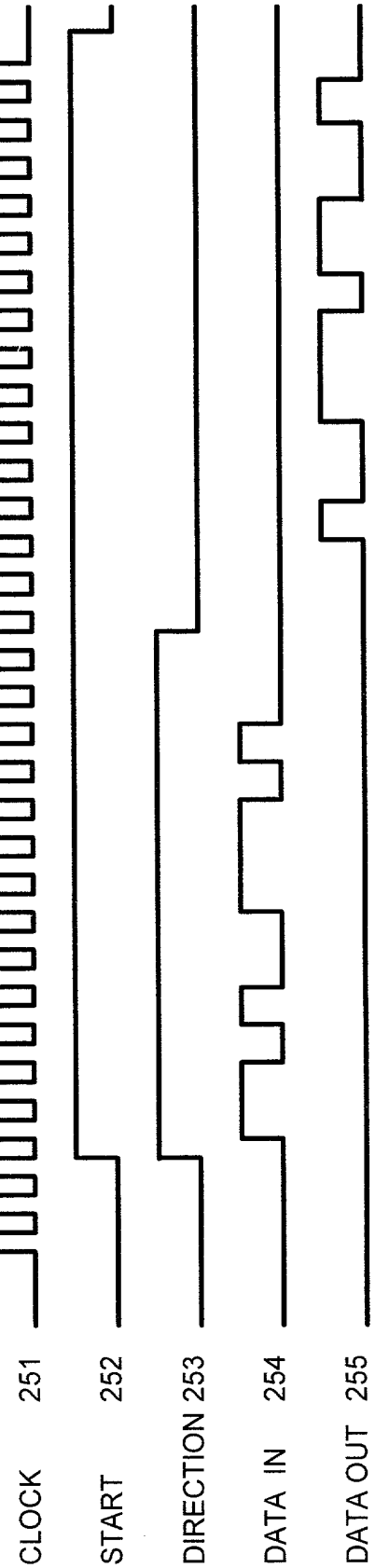


FIG. 23

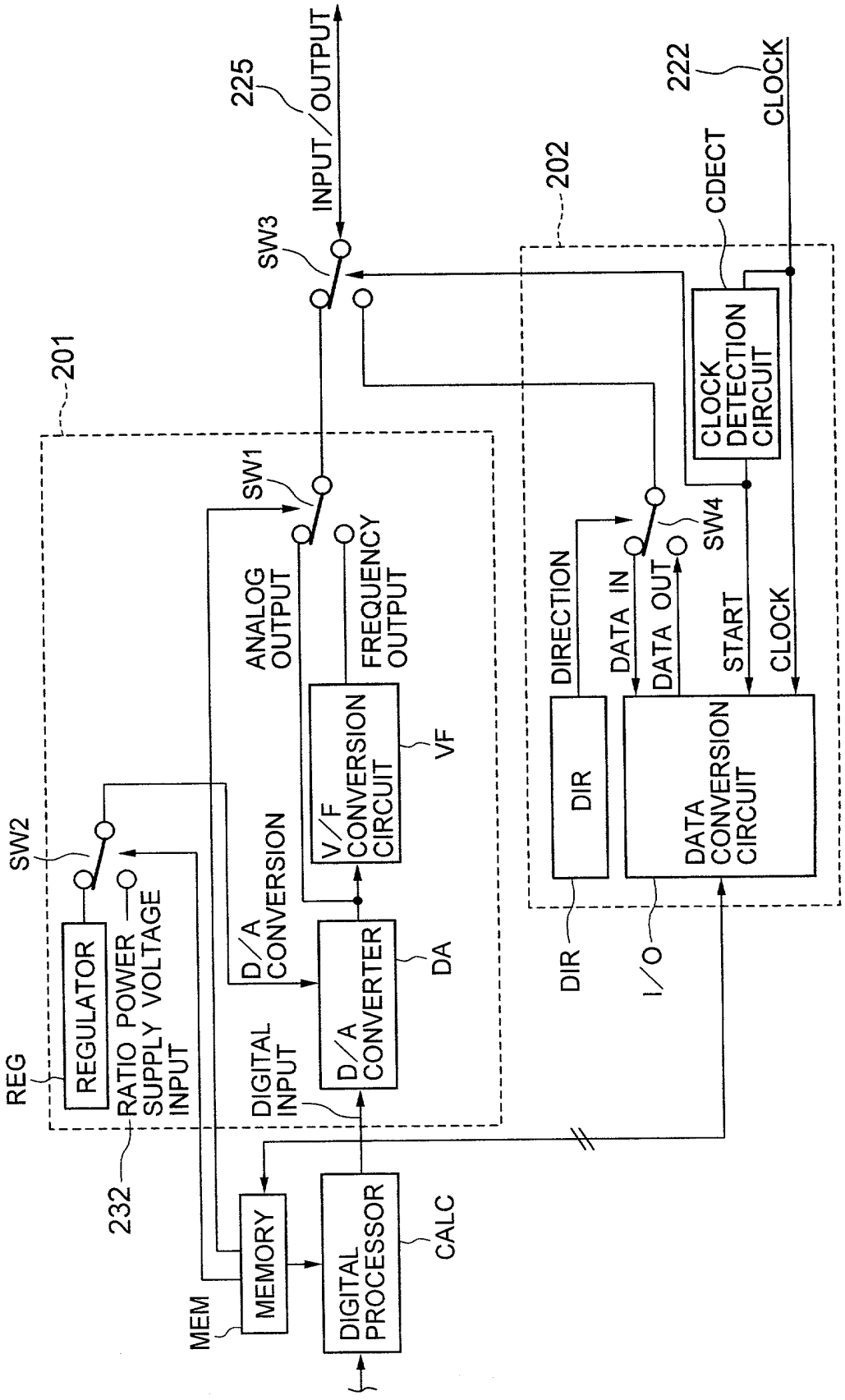

225
INPUT/OUTPUT
222
CLOCK
202
CDECT
SW3
201
CLOCK DETECTION CIRCUIT
SW1
SW4
ANALOG OUTPUT
FREQUENCY OUTPUT
DIRECTION
DATA IN
DATA OUT
START
CLOCK
SW2
V/F CONVERSION CIRCUIT
VF
DIR
DATA CONVERSION CIRCUIT
D/A CONVERSION
REGULATOR
RATIO POWER SUPPLY VOLTAGE INPUT
D/A CONVERTER
DA
DIR
I/O
REG
DIGITAL INPUT
232
MEMORY
DIGITAL PROCESSOR
CALC
MEM

FIG. 24

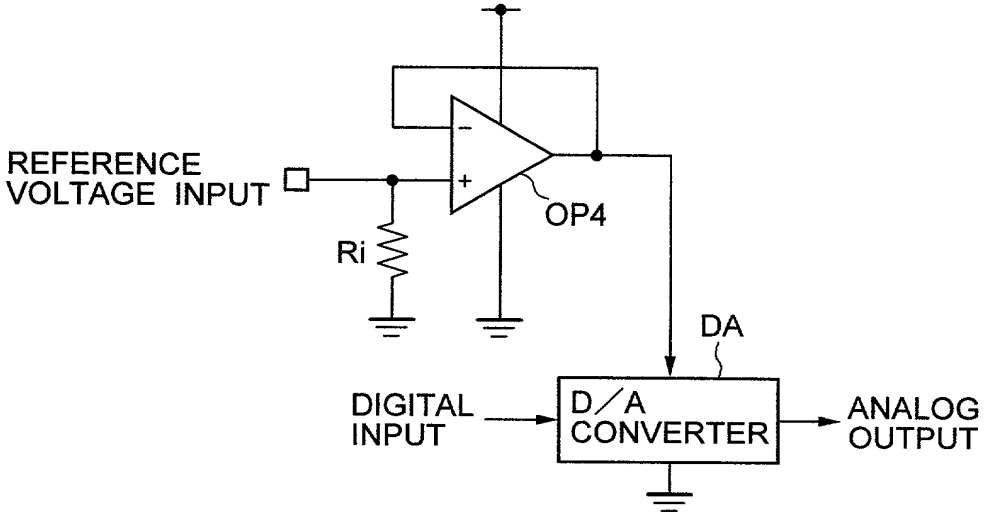

REFERENCE
VOLTAGE INPUT
Ri
OP4
DA
DIGITAL
INPUT
D/A
CONVERTER
ANALOG
OUTPUT

FIG. 25

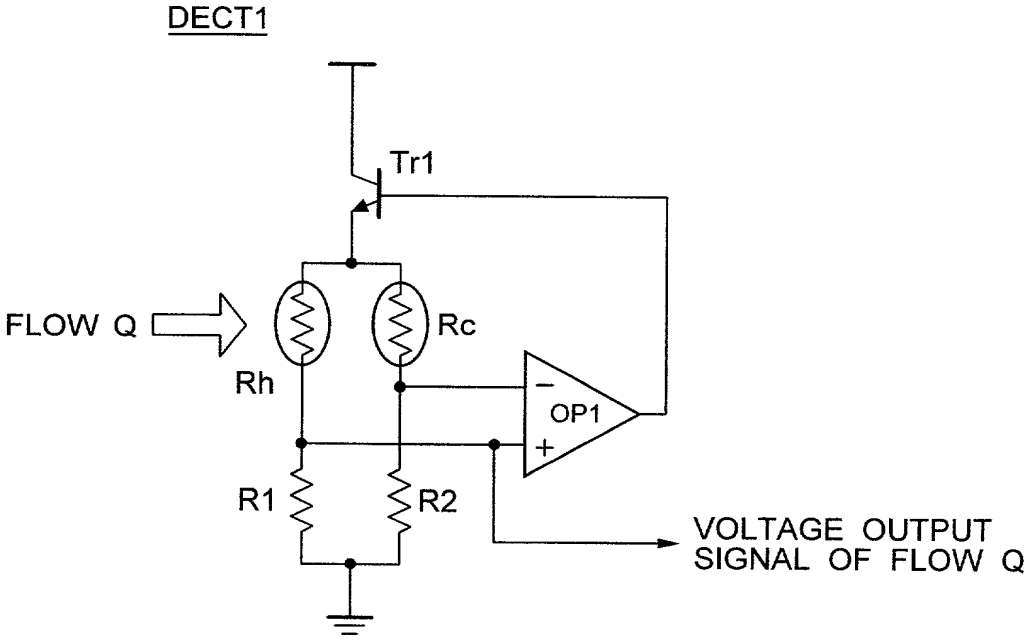

DECT1
Tr1
FLOW Q
Rh
Rc
OP1
R1
R2
VOLTAGE OUTPUT
SIGNAL OF FLOW Q

FIG. 26

DECT2

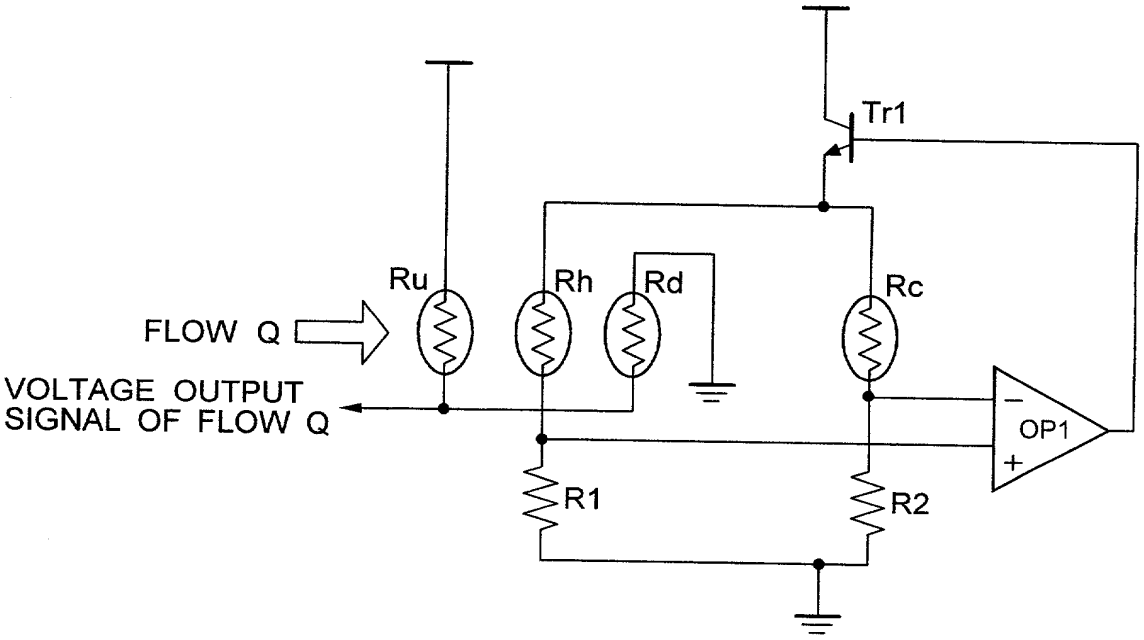


FIG. 27

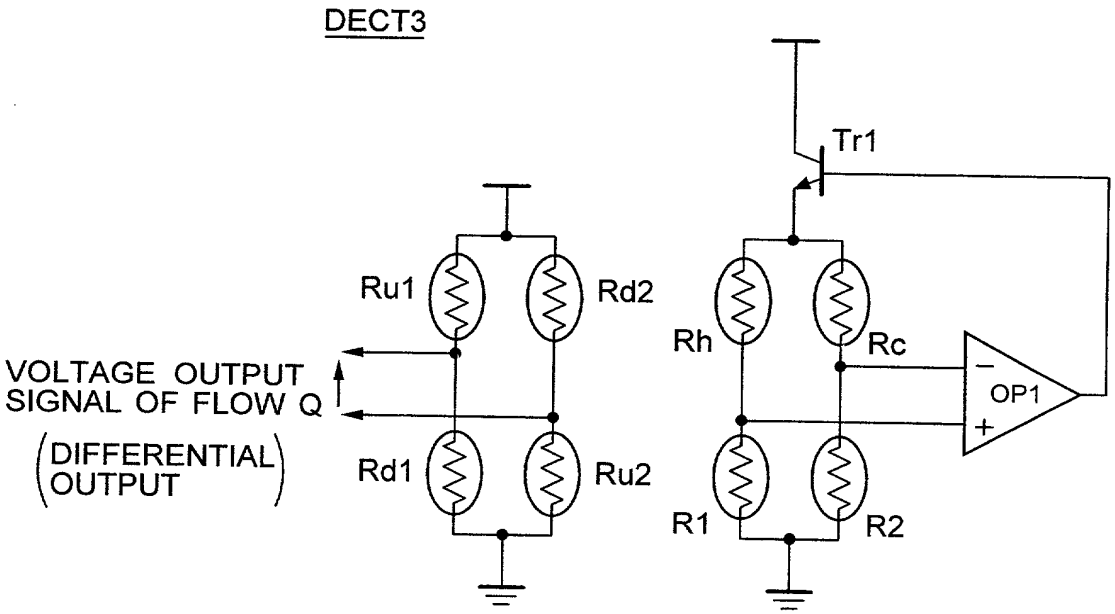
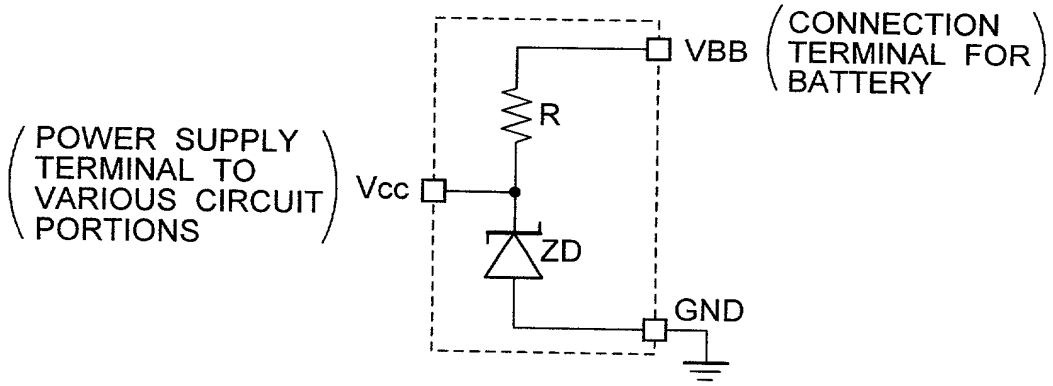
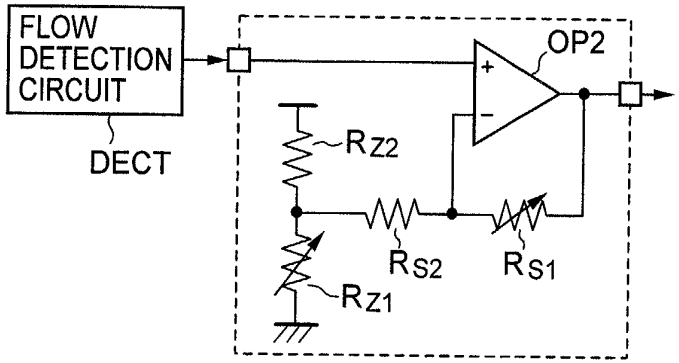
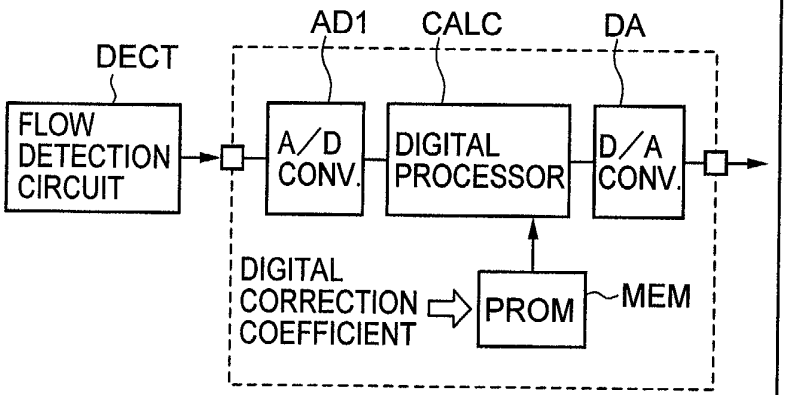

DECT3
Tr1
Ru1
Rd2
Rh
Rc
VOLTAGE OUTPUT
SIGNAL OF FLOW Q
(DIFFERENTIAL OUTPUT)
OP1
Rd1
Ru2
R1
R2

FIG. 28


VBB
(CONNECTION TERMINAL FOR BATTERY)
R
(POWER SUPPLY TERMINAL TO VARIOUS CIRCUIT PORTIONS)
Vcc
ZD
GND

FOOE80" DE02h660

FIG. 29

TYPE	(a) ANALOG ADJUSTMENT	(b) DIGITAL ADJUSTMENT
CIRCUIT CONFIGURATION		
ADJUSTMENT METHOD	RESISTOR TRIMMING	ELECTRIC TRIMMING (STORED IN PROM)
MAN-HOUR OF ADJUSTMENT	LARGE	SMALL

Crowell & Moring, L.L.P.
Serial No. NOT YET ASSIGNED
Attorney Docket No. 381AS/50350
Takafumi MATSUMURA
Page 20 of 20